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No. IV.

Description of Six New Species of the Genus Unio, embracing the Anatomy of the Oviduct of one of them, together with some Anatomical Observations on the Genus. By Isaac Lea.—Read before the American Philosophical Society November 2d 1827.

Preliminary Remarks.

IN the present contribution to the science of Conchology, I have endeavoured to be as brief as I thought the subject would permit.

I have often felt the great inconvenience sustained from too short and indefinite descriptions; and am therefore fully sensible of the necessity, for the proper distinction of the species, of a more minute notice of their characters than is usually given. In this Mr Barnes has shewn a laudable example, and he deserves the acknowledgments of the conchologist*.

It will be observed I have followed his plan of dividing the margin of the disk into eight parts, reversing his posterior and anterior margins.

* Swainson says, "Although Lamarck has described so many (Uniones), the short descriptions he has given, and the want of figures to elucidate them, render it impossible to determine accurately one half the species which he has enumerated."

The genus *Unio*, established by Bruguières, and placed by Cuvier* in his fourth class of mollusques, les acéphales, and second family, acéphales testacés, or the mytilacés; and by Lamarck in his eleventh class, conchifères, first order, conchifères dimyaires, thirteenth family, les nayades; is to the conchologist one of the most interesting of all the genera. Recent American writers on the subject have added many new species to this genus, and other new ones are almost daily discovered.

I propose now to add six species, which I believe to be distinct from any hitherto described. In doing which, I give very exact descriptions accompanied by drawings, with a hope they may not hereafter be confounded with other species.

The constant and perplexing changes which the species of this genus assume have led even the accurate Lamarck into the error of describing several varieties as different species; and it is not without due hesitation and caution that I am induced to add the present. It has been doubtful with some conchologists whether the species of the genus *Unio* are not the mere varieties of one species†. To the naturalist, who has had the opportunity of examining numerous specimens, the gradations are so interesting, and at the same time so perplexing, that he is lost in the maze of their changes, and he seeks almost in vain to draw a distinctive line between them; for even the tuberculated shells sometimes pass by almost insensible gradations into smooth ones. Although this line may not always be satisfactorily drawn, I think their division into species should be retained, if it were only for the sake of system.

The comparative anatomist finds in the animal of the *Unio* an organization very far advanced towards a state of perfection. Lamarck places it, in his scale of perfection, higher than insects, and we cannot be surprised at this, when we examine its structure and find it possessed of brain, heart, branchiæ,

* Règne Animal, vol. ii. p. 453.

† The following genera, separated from the genus *Unio*, dipsas (Leach), hyria (Lamarck), alasmadonta (Say), damaris (Leach), cannot in the opinion of Mr Swainson retain their station among the genera.

liver, intestines, and an arterial and venous circulation, so complete as to excite our greatest admiration.

Taking the natural position of the animal, I have reversed the anterior and posterior margins as used by Linnæus, Bruguières, Lamarck, Bosc, and others; and have followed Cuvier* and Blainville. That margin which has the ligament between it and the beaks is considered by Lamarck as the anterior margin, but it will be found on examination not entitled to be so considered, for two reasons: 1. The mouth over which is situated the brain is placed in the opposite margin. 2. When the animal is in progressive motion, this opposite margin is always pointed in the direction of its progress. I therefore follow Cuvier in his anterior and posterior margins, because they are founded in truth.

A recent and very accurate writer, Blainville, gives us so simple an explanation of the position in which a bivalve should be placed, that I am induced to extract it. He says—"We suppose the shell to cover the animal, and that it is passing from the observer, the head (mouth) in front. The beaks should be above—the ligament between the beaks and the observer. In this position the opposite side to the beaks would be the base, and the two extremes of the perpendicular diameter of this direction would be, the one anterior, the other posterior."

Of the habits of this animal we know little; future observations must open to us an interesting history of them. With regard to their food, it seems to be a matter of doubt upon what they subsist. I have strong reasons to believe they feed upon animalcula, which are ever found to exist in water and which they might separate from the constant stream, which they pass from the posterior part of the shell, and which must be taken in at another part. This interesting operation I witnessed frequently in a vessel in which I kept them for some months. If the water was not changed for twenty-four hours, I uniformly found my interesting captives perfectly quiet, but within

* Règne Animal, vol. ii. p. 472.

a few minutes after it was changed, they as uniformly commenced the passage of this constant stream. I cannot suppose this operation to be for the sole purpose of breathing, as there is no intermission in the stream of the water, and the quantity thrown out is too great for this purpose only. I believe it to be the result of the action of the separation of the animalcula from the water.

Lamarck informs us that the animal of the anadonta (which is essentially the same with the unio) is hermaphrodite and seems viviparous; for the eggs pass into the oviduct placed along the superior branchiæ, where the young are found with their shells complete. In the dissection of an anadonta undulata nearly three inches long, I met with the oviducts charged with about 600,000 (as nearly as I could calculate) young shells perfectly formed, both valves being distinctly visible with the microscope.

There cannot be a doubt that the two pairs of muscles, which support the foot and serve by their alternate action to give the animal locomotion, are entirely distinct from the great anterior and posterior muscles, which seem but to serve the purpose of closing the valves opened by the elasticity of the ligament. The cicatrices of the muscles of the foot, anteriorly, are placed *under* the great anterior cicatrix, posteriorly *over* the great posterior cicatrix, and are sometimes confluent with the great cicatrices, sometimes entirely distinct from them.

It is necessary to notice here another set of attaching muscles, which seem to have escaped attention. We find, on closely examining the region of the cardinal tooth, a small irregular row of muscular impressions. In those species which possess large lobed teeth, these will be found generally on the inner side of them and somewhat underneath. In the more fragile shells, possessing comparatively small teeth, such as the *alatus*, *gracilis*, &c. we find these impressions in the cavity of the valve beneath the beaks. To this part of the shell I found in many species the animal to be quite strongly attached. It seems to serve to support the mantle, branchiæ,

&c. by the centre, and in this certainly serves a very useful purpose.

Being exceedingly anxious to examine the animals of the various species of the *Unio* from the Ohio, my brother, T. G. Lea, kindly sent me thirteen species and many varieties, which, with the assistance of Mr Stewart, were carefully dissected. Those consisted of the species *mytiloides* and *metanевра* of Rafinesque; *siliquoideus*, *triangularis*, *gibbosus* and *cornutus* of Barnes; *purpureus*, *alatus*, *ovatus* of Say; *Æsopus* of Green; *irroratus* and *ellipsis* now first described. This examination furnished me with several interesting results. It confirmed me entirely in my belief that the oviducts of the *irroratus* were different from any other species yet examined; a drawing and description of which will be found in this paper. The prolongation of the sacks of the oviducts is peculiarly interesting. In some of the varieties of the *cornutus*, which seem to run into the *Æsopus*, we found the posterior and inferior parts of the shell unnaturally extended. The mark of the animal on the shell had its usually curved shape, while the mantle, quite callous, extended to a protruded and irregular margin.

It has been a matter of speculation how the calcareous matter was secreted to increase the outer margin of the teeth as well as their whole surface. In this examination we found the surface of the broad teeth, some of which were near half an inch thick, to be completely covered with a prolongation of the mantle, extending from the great anterior to the great posterior cicatrix; so that when the teeth closed they completely enveloped it. This part of the mantle is exceedingly thin and transparent.

In the study of this genus, we are naturally attracted by the beautiful rays which frequently are found in the epidermis. This to the unpractised eye would seem to be a sufficiently distinctive characteristic to mark a species. There is, however, no character more fleeting and various. The young of many species uniformly possess rays, and we sometimes find fine adult specimens of extreme beauty. The

naturalist is therefore obliged to abandon this character as almost useless. In noticing the colouring of the epidermis we must not pass unobserved the peculiar spots which are found on the cylindricus of Say, the metanevra of Rafinesque, and triangularis of Barnes. These have generally the form of an arrow-head, but sometimes so much elongated as to form rays. The hair like rays of the cornutus of Barnes and its varieties are peculiarly beautiful in fresh and perfect specimens; and the spotted lines covering the irroratus over its whole disk will yield to none of the painted epidermides.

In the measurements I have adopted the plan of Barnes: the greatest transverse line is the *breadth*, the greatest line perpendicular to this is the *length*, and the greatest line perpendicular to those lines, that is, from the most ventricose part of one valve to the most ventricose part of the other, is the *diameter*. We thus have the three greatest measurements of the shell, and the marginal descriptions give the form. It should be remembered that different localities produce various sizes, and even the thickness of the shell is frequently changed from this circumstance.

In considering the word "Unio" as of the masculine gender, I have followed the American conchologists, in opposition to Lamarck and other Europeans, who consider it as feminine. Ainsworth, in that part of his dictionary appropriated to pure Latinity, gives the following definition:—

Unio, onis, *m.* (*ab unus, quod in conchis nulli duo reperiantur indiscreti, i. e. similes,*) *A pearl, called a union,* because, many being found in one shell, not any of them is like the other. Plin. 9, 35. Unionum conchæ, *mother of pearl.* Suet. Ner. 31.

In Ainsworth's "Index Vocum Vitandarum" is to be found the following definition:—

Unio, onis, *f.* (*quod unum facit*) *Union, concord, agreement;* the number of one, Theol. (*In this latter sense it must be masculine, as ternio, senio, &c. *J. C.*)

* J. C. John Carey, the editor of the last edition of Ainsworth's quarto dictionary.

It is evident, that the word explained by the former of these definitions is the most proper to express a genus of shells; and consequently, in *Conchology*, the word *Unio* is masculine.

1. UNIO CALCEOLUS. Plate III. fig. 1.

Testâ inæquilaterali, transversâ, aliquantulum cylindraceâ, tenuiter rugatâ; dente cardinali prominente.

Shell inequilateral, transverse, somewhat cylindrical, finely wrinkled; cardinal tooth prominent.

Hab. Ohio. T. G. Lea.

My Cabinet.

Cabinet of Prof. Vanuxem.

Diam. .6, Length .8, Breadth 1.5 inches.

Shell ventricose, cylindrical, transverse—substance of the shell thin, rather thicker anteriorly—beaks slightly elevated, undulated and touching; not decorticated—ligament short, partly concealed by the beaks—dorsal margin straight; posterior dorsal margin oblique and carinated; posterior margin angular; posterior basal margin curved; basal margin nearly straight; anterior and anterior dorsal and basal margins rounded—epidermis dark green at the margin and becoming lighter towards the beaks; rays indistinct—cardinal tooth of right valve prominent and somewhat pointed; the single tooth of this valve shuts in before the tooth of the left valve, instead of passing into it; the tooth of the latter valve is emarginate—lateral tooth very short and single in both valves—posterior cicatrices confluent, as are also the anterior ones—cavity of the beaks deep—nacre pearly, white and silvery, iridescent in the posterior margin.

Remarks.—This curious little shell is peculiar in its prominent curved tooth, shutting in before that of the other valve.

Its nacre is uncommonly silvery. It swells considerably along the posterior umbonial slope. This causes its greatest diameter to be semidistant between the beaks and posterior margin.

I have given a view of the right valve of this shell for the purpose of exhibiting its remarkable tooth. It might at first be considered as a malformation, but in the three specimens which I have seen this character has been uniform.

The calceolus approaches as nearly in its general appearance to the donaciformis as to any other species. It is however a thinner shell, and differs in the teeth as well as the colour of the epidermis.

2. UNIO LANCEOLATUS. Plate III. fig. 2.

Testâ transversim elongatâ, compressâ, posticè subangulatâ; valvulis tenuibus; umbonibus vix prominentibus; dente cardinali acuto, obliquo.

Shell transversely elongated, compressed, subangular behind; valves thin; beaks scarcely prominent; cardinal tooth sharp, oblique.

Hab. Tar River at Tarborough.

My Cabinet.

Professor Vanuxem's Cabinet.

Cabinet of the Academy of Natural Sciences.

Mr Nicklin's Cabinet.

Peale's Museum.

Diam. .5, Length .7, Breadth 1.7 inches.

Shell transversely elongated, elliptical—substance of the shell rather thin—beaks scarcely elevated, decorticated—ligament small, terminating between the beaks—dorsal margin slightly curved; posterior dorsal margin carinated; posterior margin subangular; posterior basal and basal margins curved; anterior and anterior dorsal and basal margins rounded—epidermis lemon-yellow and olive-yellow, with transverse lines of growth, glabrous—cardinal tooth compressed, crenulated and oblique—lamellar tooth straight, long and rather abrupt—posterior cicatrices confluent, anterior cicatrices distinct—

cavity of the beaks shallow—nacre salmon colour and iridescent; colour stronger under the beaks, from which beautiful fine rays diverge to the margin.

Remarks.—This species, which I have seen only in Tar River, N. C., approaches more closely to the unio pictorum of Europe than any yet discovered in this country. When I first found it, I felt assured it was the same; but upon closer examination and comparison find it to be essentially different. The cavity of the beak is much less and the cardinal tooth shorter and more lobed.

3. UNIO DONACIFORMIS. Plate IV. fig. 3.

Testâ inæquilaterali, transversâ, cuneatâ, rugatâ; dente cardinali prominente; umbonibus posticè angulatis; margine dorsali posteriori subcarinatâ.

Shell inequilateral, transverse, cuneiform, wrinkled; cardinal tooth very prominent; beaks angular behind; posterior dorsal margin subcarinate.

Hab. Ohio. T. G. Lea.

My Cabinet.

Diam. .7, Length 1.0, Breadth 1.5 inches.

Shell not very thick, rounded before and pointed behind—substance of the shell not thick—beaks slightly elevated, not decorticated, almost touching; angulated by an oblique carina passing from the beaks to the posterior margin; this causes a slight concavity from the beaks towards the posterior margin—ligament passing to the point of the beaks—dorsal and posterior dorsal margins slightly curved, the latter subcarinate; posterior margin acutely angular; posterior basal margin nearly straight; basal margin curved; anterior and anterior dorsal and basal margins rounded—epidermis olive, with green rays diverging from the beaks to all parts of the margin; surface glabrous and slightly wrinkled; has distinct

marks of growth—cardinal tooth large, prominent, serrated; in the left valve deeply divided by the entering of the opposite tooth—lateral tooth abrupt—posterior cicatrices distinct, anterior cicatrices also distinct—cavity of the beaks rather deep—nacre pearly white and iridescent in the posterior margin.

Remarks.—The characteristics of this little shell are its angulated posterior slope giving it in some measure the form of a donax, and its large divided cardinal tooth. Its beautiful angulated beaks approach so closely together as scarcely to admit the edge of a piece of fine paper.

In its most prominent character, the peculiar angulated slope, it most resembles the ovatus of Say, but differs greatly in the size, the ovatus being four or five inches in breadth, and very much more inflated. The latter has a double cardinal tooth in each valve; the donaciformis only in the left valve.

4. UNIO ELLIPSIS. Plate IV. fig. 4.

Testâ figuram ellipseos habente, longitudinali, ventricosâ; valvulis crassis, umbonibus ferè terminalibus; dentibus grandibus et distinctis.

Shell elliptical, longitudinal, ventricose; valves thick; beaks nearly terminal; teeth large and well defined.

Hab. Ohio. T. G. Lea.

My Cabinet.

Cabinet of T. G. Lea.

Cabinet of Prof. Vanuxem.

Cabinet of Mr Nicklin.

Peale's Museum.

Cabinet of the Academy of Natural Sciences.

Diam. 1·3, Length 1·7, Breadth 2·3 inches.

Shell very thick, ventricose, margin elliptical—substance of the shell thick and ponderous—beaks thick and projecting

beyond the margin, nearly terminal, decorticated—ligament partly concealed by the beaks—epidermis reddish-brown, smooth—surface somewhat wrinkled—cardinal tooth thick, elevated, compressed at top, crenulated; direction same as lateral tooth—lateral tooth long, thick and slightly curved, abrupt—posterior cicatrices distinct, as are also the anterior ones—cavity of the beaks small—nacre pearly-white, silvery and iridescent in the posterior margin.

Var. a—red inside, rare.

Cabinet of the Academy of Natural Sciences.

My Cabinet.

Remarks.—The ellipsis approaches somewhat to a variety of the mytiloides of Rafinesque, but is more swollen and ponderous, and differs in always having an elliptical margin.

5. UNIO IRRORATUS. Plate V. fig. 5.

Testâ inæquilaterali, sub-orbiculatâ, longitudinali, tuberculatâ, rugosâ, longitudinaliter uni-sulcatâ; dente laterali abrupte terminante.

Shell inequilateral, suborbicular, longitudinal, tuberculated, wrinkled, longitudinally sulcated; termination of lateral tooth abrupt.

Hab. Ohio. T. Bakewell.

My Cabinet.

Cabinet of T. G. Lea.

Cabinet of Prof. Vanuxem.

Cabinet of the Academy of Natural Sciences.

Mr Nicklin's Cabinet.

Diam. 1·3, Length 1·8, Breadth 1·6 inches.

Shell extremely thick and swollen—nearly round, slightly elongated—substance of the shell thick and ponderous—beaks somewhat elevated and recurved, decorticated—dorsal margin rounded; posterior, posterior dorsal and posterior basal margins rounded; basal margin slightly emarginate; anterior

and anterior basal margins rounded; anterior dorsal margin slightly rounded—epidermis yellow, but filled completely over with numerous dark green spotted lines, running in a sweep from the beak to the margin. In the anterior part the crowding of these lines generally forms five or six bands, the largest being in the furrow in the middle of the shell; in the posterior part there are no bands—disks transversely and deeply wrinkled, with a slight longitudinal furrow from the beaks to the basal margin—tubercles slightly elevated and numerous, and generally situated on the wrinkles; cardinal tooth wide, depressed and sulcated; lamellar tooth slightly curved, thick, rather depressed, short and abrupt—posterior cicatrices very distinct, the smaller one being placed directly over the larger one and beneath the point of the lamellar tooth—anterior cicatrices distinct, the great one deep—cavity angular and exceedingly small for the size of the shell—nacre pearly white and silvery.

Remarks.—The very minute and delicate spotted lines which pass from the beaks to the margin of this species well characterize it. They are so fine and approach so nearly to each other as to give a general olive appearance to the disk, the ground of which is really yellow. I have not observed this to pervade completely the surface of any other species, and in this it is constant. The substance of the shell is exceedingly massive and ponderous, more so for its size than any other species which I have seen. The animal is the only one in the organization of which, during my examination of this genus, I have been able to detect any essential difference. From the shell being longitudinal and peculiarly massive, we might be led to suspect a conformation different from the other species, and such is the case.

By the exertion of my brother T. G. Lea, I have been fortunate enough to obtain three individuals of this species in a state of impregnation considerably developed. In those I observed an appendage, in form of a depressed cone, attached to the branchiæ on either side, and a very slight examination fully satisfied me these were the oviducts.

In all the other species which I have examined I have found the ovaries and oviducts as described by Cuvier, Bosc, Carus, &c. The oviducts in these lie in a direct line between the two great muscles, and are attached to the upper pair of branchiæ. In the *irroratus* this space is so small, as is also the cavity, that it seems to require a different conformation to accommodate the oviducts, and thus we find them *pendent*, and not placed along the plane of the branchiæ. The long sacks containing the ova are inserted about half way up the branchiæ and somewhat posterior to the centre. The number of these sacks in my three specimens consists of eight in two, and seven in the other. The posterior sack is the outer or surrounding one, and measured two inches; the second and fourth 2·2; the third 2·4; the fifth 1·9; the sixth 1·6; the seventh 1·4. In diameter the sacks are nearly the same size, the interior ones being rather smaller than the exterior, which measures one-twentieth of an inch.

These measurements were effected by separating the membranes which connect the sacks together and stretching them out. The diameter of the cone is ·6; its elevation ·2 of an inch. The outer sack terminates after making one revolution; the second advances one-third on the succeeding revolution, and each succeeding one obeys the same law until the last terminates in the centre, and the mass having performed three revolutions, the whole forms a depressed cone.

This curious arrangement of the sacks to form the depressed cone, which has its base resting on the region of the stomach, is admirably calculated by the economy of nature to harmonize with the construction of shell, which presents only at the centre of its disks room for the essential purpose of propagation. See plate V.

Fig. 6 represents the interior, fig. 7 the exterior of the oviduct, the mantle being removed.

a the mouth.

b the great anterior muscle.

c the superior right branchiæ.

- d* the great posterior muscle.
e the inferior right branchiæ.
f the right oviduct.
g the foot.
h the superior left branchiæ.
i interior view of the oviduct.
-

6. UNIO LACRYMOSUS. Plate VI. fig. 8.

Testâ sub-quadrangulâri, inæquilaterali, posticè angulatâ, transversâ, tuberculatâ; dente laterali abruptè terminante.

Shell subquadrangular, inequilateral, angular behind, transverse, tuberculated; termination of lateral tooth abrupt.

Hab. Ohio. T. G. Lea.

My Cabinet.

Cabinet of T. G. Lea.

Cabinet of Prof. Vanuxem.

Diam. .9, Length 1.7, Breadth 1.8 inches.

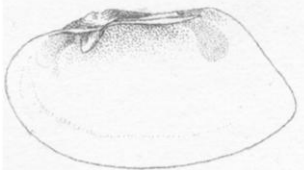
Shell rather depressed and rounded anteriorly—substance of the shell thick—beaks slightly elevated with the ligament passing between them, recurved and almost touching, free from decortication, and covered with beautiful delicate raised points—when viewed on the back all the visible part is covered with them—dorsal margin oblique; posterior dorsal margin subangular, carinated; posterior margin angular; posterior basal margin emarginate; basal, anterior and anterior dorsal and basal margins rounded—epidermis yellow-green and very smooth, almost white at the point of the beaks, anteriorly slightly rayed—disks tuberculated, having a smooth channel, margined by two rows of tubercles or raised points, running from the point of the beaks, and diverging one to the basal, the other to the posterior margin—tubercles, enlarging towards the base, taking the form of flowing tears, and resembling coagulated gum; they are very minute at the point of the beaks—undulated delicately along the posterior dorsal mar-

gin—have one distinct line of growth—cardinal tooth very wide, depressed and sulcated—lamellar tooth straight, short, crenated and abrupt—posterior cicatrices confluent; anterior cicatrices distinct, the great one deep and partly surrounding the cardinal tooth—cavity not deep, but angular, and extending under the cardinal tooth—double impression of the mantle very perceptible—nacre pearly white and silvery.

Remarks.—This rare shell forms without doubt the most beautiful and perfect species yet discovered of this genus. Its beautiful tubercles, lively colour and delicately pointed white beaks, together with its strikingly pure nacre, entitle it to a precedence over all that have yet found their way to our cabinets. The form of the tubercles is very peculiar and they distinctly mark this fine species. The specimen represented in the drawing is the largest of five which I have seen.

This species is more nearly allied to the *metanevra* of Rafinesque than to any other. It differs however, essentially, in its having a greater number and more distinct tubercles; its colour, and the tuberculous ridge of the latter being replaced by a smooth furrow, enlarging from the beaks to the posterior basal margin and bordered by two rows of small tubercles. The *metanevra* is also larger and more ponderous.

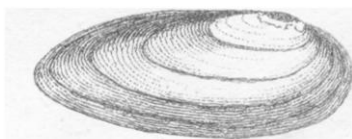
1



Unio calceolus.

Drawn by I. Lea.

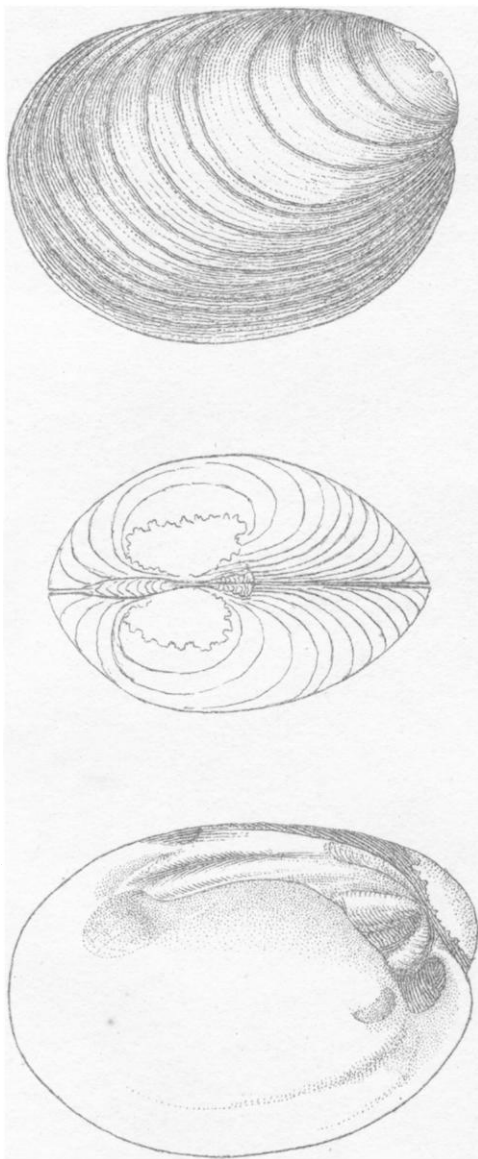
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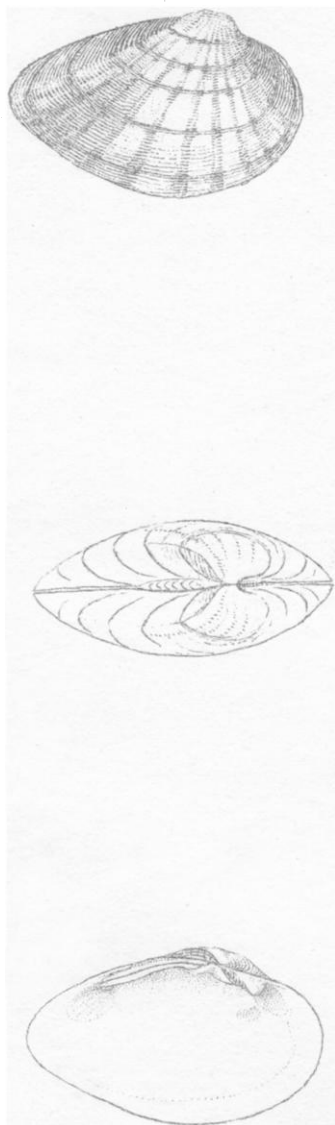
Unio lanceolatus.

Drawn on Stone & Pr. by J. Drayton.

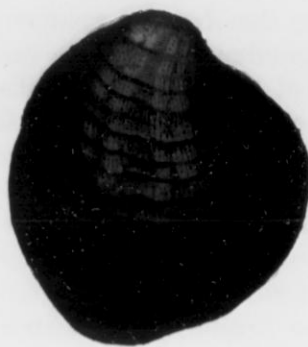
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*Unio ellipsis.**Drawn on Stone & Pr. by J. Drayton.*

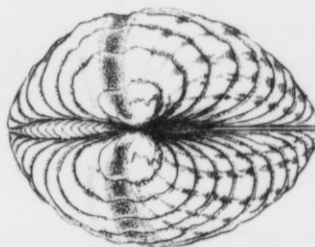
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*Unio donaciformis.**Drawn by I. Lea*

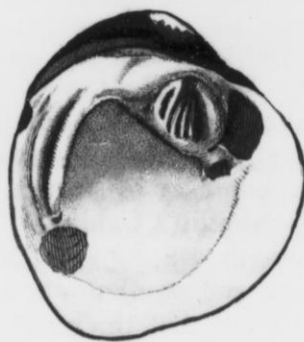
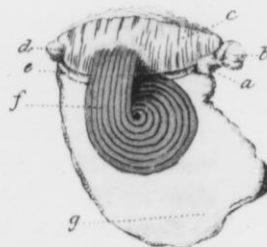
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6



7

*Unio irroratus*

8



Unio lacrymans.